drawn into the measuring apparatus and made to occupy a volume which is equal to 79 per cent of that previously occupied by it. The difference of pressure from the former value is noted. As normal air contains 21 per cent oxygen the second pressure will be approximately equal to the first, and it is the difference between the two which indicates the departure of the oxygen content of the sample from that of normal air. 3 mm. pressure-difference on the mercury column corresponds with 1 per cent difference in oxygen content and readings can be obtained to 1/20th of a mm., or 1/60th of 1 per cent. The results of a test on a known sample of air (20.42 per cent of oxygen) are given. The value obtained by the use of the apparatus was 20.39 per cent.—*J. S. Di[nes]*.

A METHOD OF MEASURING VISIBILITY.

By A. WIGAND.

[Reprinted from Science Abstracts, Sect., A, Aug. 30, 1919, §1000.]

An instrument is described consisting of seven circular transparent glasses, mounted around a rotating disc attached to a frame, which can be fitted over the observer's eye in such a way that the glasses can be brought successively across the field of view while the eye is sheltered from stray side-light. The glasses vary regularly in opacity and are numbered 2, 4, 6, 8, 10, 12, and 14 respectively corresponding to the degree of opacity on an arbitrary but fixed scale. A rotating arm mounted on the axis of the disk carries another transparent glass of which the opacity is 1 on the same scale, so that an observer can interpose an opacity corresponding with any whole number from 1 to 15 between his eye and an object. Definite objects having been selected at various known distances from the observer, the method of observation is to select that transparent glass through which an object can just be seen, and to name as corresponding opacity given by the instrument the number of the glass next higher on the scale, through which the object is invisible. Experiment has shown that on a day of max. visibility the mean opacity number of the instrument is 14.3. If a is the opacity number on any occasion, $14.3-a$ is a measure of the lack of transparency of the atmosphere for the particular object seen, and $(14.3-a)/l$, where l is the distance of the object, is a measure of the lack of transparency of the air for unit distance of the object. The reciprocal of this, namely, $l/(14.3-a)$ is defined as the visibility (*Sicht*) of the air. Certain precautions required for making an observation, a list of causes of deterioration of visibility, and a number of actual observations are also given, together with a diagram which serves for the rapid evaluation of the above quantity for different values of a and l.—*R. C.*

LIGHTNING FIGURES.

In Symons's Meteorological Magazine for December, 1919, is a note by James G. Wood correcting the statement made by Dr. Newell in a note in the October number of the same magazine (abstracted in Monthly Weather Review, October, 1919, p. 729) relative to "impressions of branches and leaves" on the human body due to lightning strokes. Such markings are not uncommon and are due to the "ramification of an electric discharge."—*C. L. M.*

THE TOTAL SOLAR ECLIPSE OF MAY 29, 1919, AT CAPE PALMAS, LIBERIA.[1]

By Dr. LOUIS A. BAUER.

(Author's abstract.)

[Dated: Washington, D. C., Dec. 6, 1919.]

The station at Cape Palmas, Liberia, (lat. 4° 22′ N., long. 7° 43.7′ W.) was one of five principal stations at which magnetic and allied observations were carried out by the Department of Terrestrial Magnetism of the Carnegie Institution of Washington in connection with the solar eclipse of May 29, 1919. Two of these stations, Sobral, Brazil, in charge of Mr. D. M. Wise, assisted by Mr. A. Thomson, and Cape Palmas, Liberia, in the author's charge, who was assisted by Mr. H. F. Johnston, were inside the belt of totality. A third station, at Huayao, Peru, north of the totality belt, was in charge of Dr. H. M. W. Edmonds; the fourth station south of the belt of totality, at Puerto Deseado, Argentina, was in charge of Mr. A. Sterling; and the fifth, about 100 miles north of the belt of totality, at Campo, Cameroun, was in charge of Mr. Frederick Brown. Observations were also made at a secondary station, Washington, by Mr. C. R. Duvall.

In addition to these stations, special magnetic observations were made at the Department's magnetic observatory at Watheroo, Western Australia, and at observatories all over the globe, both inside and outside of the region of visibility of the eclipse. Reports have already been received from many of these foreign observatories. The reports indicate that the magnetic conditions were ideal for the detection of a possible magnetic effect of the order to be expected from our previous eclipse magnetic observations. As soon as the various observations have been examined and discussed, a paper will be presented before the Society upon the results obtained.

The prime object of the present paper is to give a general account of our expedition to Cape Palmas, Liberia, also to relate the phenomena observed during the total eclipse, and the experiences encountered en route to Liberia and in Liberia itself.

Totality lasted at Cape Palmas about 6 minutes and 33 seconds, longer than at any other accessible station in the belt of totality. The general indications, as the eclipse occurred during the rainy season, were that Cape Palmas would not be a suitable station for the astronomer. However, for the purpose of our investigations, it did not matter whether we had a clear sky or not, for a magnetic effect will pass through any layer of clouds. It happened, however, that in spite of general expectation, we had clear weather, and this now for the third time, whereas parties at other stations which appeared more favorable according to past meteorological records, were unfortunate. Our observation program included magnetic and electric observations, meteorological observations, shadow band observations, times of contacts and photographs such as could be obtained with our small Kodak cameras. This comprehensive program was carried out successfully, excepting the atmospheric-electric work which, owing to the deterioration of the dry-cell batteries purchased in England, had to be abandoned. Although I had stationed three observers, no shadow bands were observed this time, even greater

[1] Presented before the Philosophical Society of Washington, Oct. 11, 1919.

precautions having been taken than at Corona, Colo., during the eclipse of June 8, 1918, where they were observed.

The eclipse of May 29 as observed at Cape Palmas, was not nearly as dark, in spite of its long duration, as the much shorter one of June 8, 1918, at Corona. There was a marked difference in light, both as seen visually and as shown by the photographs, between the inner corona and the outer extension. The large red prominence was a startling object.

Clear indications were had with regard to a magnetic effect in accordance with the results obtained at previous solar eclipses.

There was a steady slight decrease in temperature from 12^h G.M.T., 0.7 minute after the first contact, to 12.7^h G.M.T., and then a more rapid decrease until 14^h G.M.T., when the minimum temperature of 79.4° F was reached. This time (14^h) was approximately 0.4^h later than the middle time of totality. The increase in temperature after 14^h was rapid, the maximum 82.7° F being reached at 14.9^h G.M.T. The hygrogram for May 29 showed the following effect: The humidity, which was 71 per cent at 12^h G.M.T. steadily increased to 78 per cent at 14^h G.M.T. There was a more rapid decrease from 14^h G.M.T. to 15^h G.M.T., when the humidity was 66 per cent. The maximum humidity, therefore, occurred at 14^h, or approximately 0.4 hour later than the middle time of totality. The barogram showed nothing marked during the time of the eclipse.

VELOCITY OF THE WIND IN HIGH ALTITUDES IN CLEAR WEATHER.

By CH. MAURAIN.

[Abstracted from Comptes Rendus, July 15, 1919, pp. 79-82.]

In order to determine the average speed of the wind in extreme altitudes, as many records of sounding balloons as possible were assembled, and of these all those were taken which attained altitudes greater than 10 kilometers. From 198 such flights it was found that the mean speed of the wind increased in an almost linear manner from 5 meters per second at an altitude of 500 meters, to 15.6 meters per second at 11,000 meters, after which it began to decrease until it reached in the neighborhood of 8 meters per second at 19,000 meters. Of these flights, there were 11 in which a speed greater than 40 meters per second was observed, 2 in which it exceeded 50 meters per second, and one which gave a value of 55 meters per second. The last was observed at Pavie.—*C. L. M.*

THE MONSOONS OF TUNIS.

By J. ROUCH.

[Abstracted from Annales de Geographie, vol. 28, No. 153, pp. 226-229, 1919.]

The monsoon, the most important effect of the unequal heating of the continents and the oceans, is, except in a very few regions of the world, masked by the general circulation. The presence of this effect can, however, be clearly demonstrated by a method due to Allard and Angot:

The mean wind observed in any season is considered as resolvable into two components—the mean annual wind and a seasonal (monsoon) wind. From the triangle of velocities it is evident that the seasonal wind (monsoon component) is given by the diagonal of the parallelogram constructed on the mean annual wind and the mean wind observed in the given season.

Upon constructing the seasonal (monsoon) components by this method, and expressing each in terms of the mean annual wind, for six selected stations in Tunis, it is found that there is a strong winter monsoon component normal to the coast line, and directed toward the sea, for all coast stations, and that there is an equal monsoon component, oppositely directed, in summer.

At the inland stations, however, the effect is scarcely noticeable. At 200 kilometers from the coast the seasonal (monsoon) components are practically nil. Since isobaric charts show that the relative distribution of pressure over the eastern Mediterranean and southern Tunis is reversed between the two seasons, this fact can not be explained if it is assumed that the differences of pressure are alone responsible for the winds. Probably the temperature gradient, which is steep near the coast, must also be considered.

It is known that at some altitude the direction of the monsoon wind should be opposite to that of the surface. The aerological observations at Bizerte and at Sousse, Tunis, are expected to furnish information as to this altitude variation.—*E. W. W.*

ATMOSPHERIC WATER.

By OSCAR E. MEINZER.

[Abstracted from "Outline and Glossary of Ground-water Hydrology," an unpublished U. S. Geol. Surv. manuscript, pp. 1-7.]

The term "water" is used in geophysics to denote hydrogen monoxide, or chemically pure water, together with the solid, liquid, and gaseous materials held by the hydrogen monoxide as it exists in the earth in its natural condition."

The water of the earth may be divided into three parts—(1) Atmospheric water, the solid, liquid, and gaseous water which exists in the atmosphere; (2) surface water, the solid, and liquid water which exists on the upper surface of the lithosphere, i. e., in the hydrosphere; (3) subsurface water, the solid, liquid, and gaseous water which exists below the surface of the lithosphere. Water is often discharged from the atmosphere into the lithosphere, and vice versa, but, the capacities of these being limited, the hydrosphere becomes the receptacle for all water which the other "spheres" do not hold. Furthermore, the water-holding capacity of the atmosphere space alone changes rapidly and greatly, and the different parts of the atmosphere alternately receive water from, and yield water to, the hydrosphere and the lithosphere. The frequent changes in the water capacity of the atmospheric space are the principal cause of the continuous movement of water in the hydrosphere and lithosphere, and the principal agency that prevents the attainment of static equilibrium in the water of the earth.

Atmospheric water in the gaseous state is known as atmospheric water vapor. The solid and liquid water of the hydrosphere and lithosphere, and also any solid and liquid water which may exist in the atmosphere, are the sources of atmospheric water vapor; the process of conversion being known as evaporation, or vaporization. The term "evaporation" is also used to designate the quantity of water that is evaporated. When thus used it is generally expressed as depth of liquid water removed from a specified surface, most commonly in inches or centimeters. The rate of evaporation is expressed in units of depth per unit of time. The evap-